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DATE: 14 May 1968

TO: Chairman, COMIREX

FROM:

SUBJECT: MC&G Study

REMARKS:

[redacted] has prepared the attached study in response to a request from the Director. Before sending it forward he has requested comments from the Intelligence Directorate.

Please forward your written comments as soon as possible to the ADDI.

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9 May 1968

MEMORANDUM FOR: Dr. R. J. Smith
DDI

SUBJECT : MC&G Study

1. The attached study, requested by the DCI, concerns MC&G and the relationship of the DCI to activities associated with that program.

2. Personnel of your Directorate have assisted in the compilation and assessment of information for the study but it has not been formally staffed within your Directorate. For this reason, I should appreciate your comments prior to finalization and forwarding to the DCI.

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A/D/DCI/NIP

Attachment a/s

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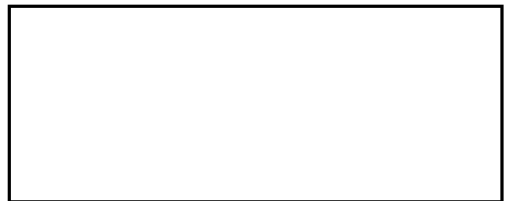


A

STUDY OF
MAPPING, CHARTING, AND GEODESY

May 1968

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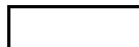
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(1)



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I. Introduction

Authority

This study was requested by the Director of Central Intelligence.

Purpose

To establish more precisely the degree of need for overhead photography as an input for mapping, charting and geodesy, the coverage necessary to meet the mapping and charting need at a reasonable rate, and the costs associated therewith.

Guidance

The guidance given for the conduct of the study included, but did not limit it to, the following major points:

- a. To what degree is the worldwide mapping and charting program an intelligence requirement?
- b. Are the photographic inputs to this program essential to the final product?
- c. Is photographic coverage for this purpose being produced at a rate which is compatible with productive utilization?
- d. Will the introduction of a new high-resolution wide-area photographic capability produce a requirement to cover the world again for mapping and charting purposes?

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II. Conduct of the Study

The four basic functions associated with mapping, charting and geodesy considered by this study are: Establishment of Requirements, R&D, Collection, and Production.

The focus of the study is on the DOD MC&G program. The other government agencies, such as the Geological Survey of the Department of Interior, which have an assigned mission to produce maps and charts, and NASA, which is in the early stages of developing capabilities having to do with assessments of earth resources through overhead reconnaissance, are not considered in full detail as their programs are either complementary to, or do not have an important impact on, the MC&G programs of the DOD. The course which the NASA program will follow is not yet clear. The study group, operating under the aegis of the Scientific Advisor to the President, is considering the utilization of satellite photography for earth resources studies.

The inherent difficulty of obtaining the necessary background information has limited the scope of the study in several areas. This is most noticeable in the area of costs and R&D effort; however, the gist of these aspects has been presented.

The quantitative figures used in this study reflect a currency as of the summer of 1967, unless otherwise specified.

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III. Conclusions and Recommendations

Conclusion 1. Accuracy criteria for worldwide geodetic positions, both horizontal and vertical, for either targeting or for internal map control constitute the major factor in the determination as to whether or not the photographic products of a particular satellite system are suitable for specific MC&G purposes. In the past, in approving new accuracy requirements, there has been insufficient attention given to the possible impact such action would have on collection resources. This problem can be resolved by:

a. The USIB's requiring a thorough analysis prior to approving any more stringent MC&G accuracy criteria to meet operational needs than is demonstrably within the capability of operational systems; and

b. The USIB's establishing a policy that whenever more demanding accuracy criteria are requested to meet military operational needs, such criteria be justified on an operational basis and the USIB not commit itself as the approving authority.

NOTE: This would negate the present system by which USIB approves a request and then that approval is used as the justification for the development of new and costly resources.

Recommendation

That the DCI/USIB adopt a. above for those criteria aimed at intelligence objectives and b. for those accuracy criteria which are of a military operational nature.

Conclusion 2. The concept of maintaining as a data bank up-to-date coverage of extensive areas of the world with photography suitable for MC&G purposes rather than limiting collection to that required to meet map production schedules is the primary reason for the high volume of the collection underway and projected for the future. The data bank concept is based upon the understandable desire of the MC&G community to respond to commanders' needs rapidly in emergencies when quality maps

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do not exist for an area of concern. While the concept is a reasonable one, excessive resources can be devoted to the fulfillment of this objective, unless it is very carefully monitored as to the extent of areas to be covered and the criticality of the need for re-coverage. Two possible actions to assist in this endeavor are:

a. The DCI can point out to the DOD that the demands for photographic coverage for MC&G purposes of a considerable portion of the world are based upon the data bank concept with responsiveness to the JSOP being the controlling factor and that any action which could more precisely limit the areas of possible emergency need would result in collection as well as processing and storage savings.

b. The Chairman of USIB can require COMIREX to review carefully requests for re-coverage for MC&G on the basis of critical need versus a useful-to-have concept.

Recommendation

Approval of a. and b. above.

Conclusion 3. The actual cost of producing satellite photography for the MC&G program is not now fully identifiable because:

a. A system has not been devised for identifying all of the developmental and programming actions which are primarily in support of MC&G.

b. An accounting system has not heretofore been utilized to allocate the cost that should be charged to MC&G in relation to the coverage provided on each satellite mission.

c. The "free ride" philosophy which has generally been associated with the collection of satellite photography for MC&G purposes has contributed to this lack of a systematized accounting of costs attributable thereto.

d. There has been some logic in the free-ride approach in the past, but now, because of the increased focus of attention on the intelligence budget, it seems desirable that a specific cost accounting procedure be established. To reflect realism in the

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costing procedure, it must be recognized that both the S/I camera system and the primary camera system collect photography that is used for MC&G purposes. In order to take account of the two systems in arriving at a reasonable cost allocation, the cost of the S/I camera system could be subtracted from the total mission cost. Each of the subtotals could then be subjected to the following criteria: Determine the percentage of the total film supply of each camera system that was expended for the satisfaction of MC&G requirements. The collection cost for MC&G could then be determined on the basis of the appropriate percentage slice of the mission cost of each of the two systems. Additionally, the cost of film exposed solely for MC&G purposes and that associated with the production of dupes or prints for MC&G should also be allocated to the MC&G community.

Recommendation

1. That the DOD and the NRO be asked to identify clearly those programs in the research and development area and the costs associated therewith which are for MC&G purposes.

2. That the NRO be asked to calculate MC&G collection, film and processing costs for each photographic satellite mission in accordance with the procedures outlined in paragraph d. of the Conclusion.

Conclusion 4. Since the total map production requirement and the priorities ascribed thereto are established primarily to meet current and planned operational needs of the military forces, the validation of the requirement and priorities is by the JCS and the DOD. The magnitude of the intelligence requirement associated therewith is of a very secondary nature. However, because the program is included in the CIP, the DCI is, in some quarters, expected to exercise influence on the amount of resources that should be programmed. This problem can be addressed in either of two ways:

a. Require, either through executive order or agreement, that the DCI have an authoritative voice in establishing the requirements for all types of map coverage as well as in controlling the resources to develop and maintain such coverage. In other words, establish MC&G, without question, as an intelligence mission; or

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b. Require that the MC&G program be so presented in the CIP that those elements which are clearly of a military operational nature are identified as such so that the DCI may be associated with only that part which is of an intelligence nature. (This, at least initially, would probably have to be done in somewhat gross terms as there is obviously some overlap in definition.) The TOD exercise might be a means by which a clear determination between the two aspects of MC&G eventually could be developed.

Recommendation

That the DCI adopt procedure b. above, and

(1) Request the DOD to establish a procedure for identifying that part of the MC&G program which should be identified with intelligence and that part which should be identified with military operations. The resources chargeable to the operational aspects of the program should then be considered as non-add items in the C.I.P. insofar as the intelligence aspects of that program are concerned.

(2) Request the TOD group to develop reporting guidance which would distinguish between the intelligence and the operational aspects of the MC&G budget line items in the CIP.

Conclusion 5. The study in Part IV, paragraph 2. a., definitely establishes photography, particularly satellite photography, as an essential input to the mapping, charting and geodesy program and it undoubtedly will continue to be so. Furthermore, with the growing demand for highly accurate maps and the improvements underway and possible in photographic products, the potential for contributions by photography will increase.

Recommendation

None.

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IV. Discussion

1. Establishment of Requirements

a. General. Of the four general classes of MC&G requirements -- collection of photography by satellites, collection of material by other means, map production, and R&D -- the DCI and the USIB are directly involved only in the establishment of satellite collection requirements.

DIA establishes the requirements for nonsatellite survey data which are levied on the military departments. CIA manages a collection program to obtain locally produced maps and related source materials. Map production requirements are generated within the Department of Defense and are validated by the DIA and JCS and are not subject to USIB or DCI review. R&D requirements associated with satellite collection are normally assigned to the NRO and those identified with nonsatellite collection programs and with map production are the responsibility of the DDR&E.

From the above it may be seen that there is only a limited involvement of the DCI or of the USIB in the establishment or control of requirements relating to mapping and charting.

b. Requirements for Improved Geodetic Accuracy. Aside from the scientific desire to determine the exact size and shape of the earth, the most demanding requirement for geodetic relationships between points on the earth is that necessary to permit accurate ICBM targeting.

Global geodetic requirements based upon the targeting need were stated in USIB-D-41. 14/295 (COMOR D-13/65) 11 July 1966 and furnished to NRO for guidance. This USIB memorandum set forth the criteria for geodetic measurements to be accurate to 450 feet on the horizontal with 90 percent assurance relative to the World Geodetic System. For the Sino-Soviet bloc this is stated as being required to be accomplished by 1970. Target elevations

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throughout the Sino-Soviet bloc were expressed as required to be accurate to 300 feet with 90 percent assurance, again relative to the World Geodetic System.

c. Mapping Accuracy Requirements. The most critical map accuracy is that required by modern artillery and is expressed in USIB-D-41.14/295 (COMOR-D-13/65), 11 July 1966. These accuracies are planned for incorporation in a large-scale map at 1:50,000. Preliminary thinking in the USAF is that large-scale maps with similar accuracies will be needed by 1970 to support the tactical non-nuclear strike capability being planned for the F-111's which incorporates a highly sophisticated target identification and weapons aiming system.

The intelligence community does not require map accuracies as demanding as those needed for military operations, although no specific statement as to what those accuracies are has been made.

d. Map Production Requirements. The controlling factor in the development and production of maps, charts and geodetic data is the fulfillment of operational requirements of the JCS and the Unified and Specified Commands. The requirements are validated within the DOD as Annex G of the Joint Strategic Operations Plan (JSOP) which is developed for a 5-year period but is refined and approved by the JCS in an annual review.

When these priorities are being given their annual DIA review, the CIA submits its priority interests to DIA where they are considered along with military command requirements. After adjustments, these are consolidated by DIA into a production package and submitted to the JCS for approval. CIA ad hoc requirements are reviewed and approved by DIAMC in the context of the overall program. Under this arrangement the DCI does not have a voice in the final decision-making process as to the production priorities which are established by DIAMC.

2. Inputs to Mapping, Charting and Geodesy

a. Essentiality of Aerial and/or Satellite Photography. Overhead photography is an essential input to the mapping, charting

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and geodetic programs. It is used in various ways, either as original source material or to supplement or verify data obtained through other means. Its primary contribution is covered in the following subparagraphs:

(1) Global Geodesy. In nondenied areas, through the cooperation of friendly governments, various overt nonphotographic satellite programs are producing geodetic positioning which permits a programmed extension of the world geodetic network with a high degree of accuracy, as described in paragraph 2.b. below. Calibrated satellite photography, combined with orbital or precise tracking data, has provided the only means of extending this world geodetic system beyond those areas for which Russian triangulation and other reliable control exists (such as European Russia). This type of control extension has in the past provided the means by which targeting for current weapons systems has been accomplished. However, increased accuracy requirements will require improved systems.

(2) Mapping and Charting. Photography provides a totality of visible terrain information which makes it a unique source for map and chart production. Overhead photography, after rectification to a horizontal plane, provides not only the identification but also the correct shape and size of natural and man-made features in their relative position and elevation with respect to a network of reference control points established for a given area. It is an essential ingredient for map programs of the extent being conducted by the DOD.

(3) Geodetic Control for Map Production. A dense network of reference control points is required for map and chart compilation. Before aerial photography was available, these control points were provided by ground surveys. The use of the airplane to collect photography, combined with the development of photogrammetric methods, not only afforded significant economies but overcame barriers of physical inaccessibility. These methods are now being applied to satellite photography, which in denied areas is the only means that can provide the required control data.

b. Global Geodetic Network. Prior to the advent of the earth satellite, the establishment of a global network of primary reference

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points was severely limited by the oceans. Now, however, satellites are being utilized in both overt and covert programs to extend and relate existing geodetic datums which ultimately should result in a complete world geodetic system.

(1) Overt Programs. Several of the overt programs should result in the establishment of a primary network of reference points to an accuracy of 15 meters (90% assurance) in nondenied areas. For these points this accuracy will exceed original program objectives and should be adequate for any military or other known requirements in the foreseeable future. The National Geodetic Satellite Program (NGSP) being conducted jointly by NASA and DOD will establish a 43-point global network by photographing sun-reflecting satellites against a star background. In addition, the DOD is conducting the following overt programs: SECOR (Army) is a radio-ranging program (signal transmission to and from a transponder on the satellite) designed to tie different datums, furnish base measurements to the NGSP net, and provide data for an interim DOD World Geodetic System. The Navy DOPPLER program is a range-rate system utilizing the Doppler effect of a satellite-carried radio beacon to (a) determine center-of-mass positions at each of the NGSP points, and (b) obtaining gravity data at altitude. The USAF is conducting a PC-1000 camera program to obtain geodetic positions by photographing a satellite-borne flashing light against a star background.

In keeping with NASA policy, material produced by the overt programs will be UNCLASSIFIED and will be made available to any nation, including the communists. Since none of the U.S. overt programs, which require ground facilities at geodetic extension points, are operated in communist areas, we are currently dependent upon covert satellite photography for these vital data. This is accomplished by taking the control points that have been derived from the overt program and tying them to geographic features which are subsequently identifiable on satellite photography. From these control points geodetic positions are then extended into denied areas.

(2) Covert Programs. The KH-5 program [REDACTED] was the only covert photographic satellite system that was designed

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and flown primarily for MC&G requirements. It was a joint venture between the intelligence and MC&G communities and was the initial exposure of the USIB to the mapping and charting program. The intelligence community divided the program's responsibilities between the Air Force and CIA. The CIA had technical and operational responsibilities for the payload, while the Air Force was responsible for the booster, spacecraft, launch, tracking and recovery operations. The Department of the Army and later DIA monitored the program on behalf of the MC&G community. The primary camera system consisted of a stellar camera coupled to a 3" focal length terrain (Index) camera to provide photography which, together with orbital data, enables the positioning of features anywhere in the world. Four completely successful and two partially successful KH-5 missions have provided 48,000,000 square miles of useable photography which is still in process of exploitation. While providing much useful data, it has not been possible to meet the current accuracy requirements with the [REDACTED] product. Additional Stellar-Index photographic coverage is being produced by other satellite programs and is being utilized to meet existing requirements in areas not covered by KH-5 data. The major gap in which the required coverage has not been met is the generally cloudy equatorial belt.

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c. Geodetic Control for Map Production. The KH-5 data, as well as frame photography produced by the S/I camera of the KH-4, 7, [REDACTED] systems are used to provide supplemental photogrammetric control (Point Position Data) for the compilation of medium and small-scale maps and charts, and missile target data sheets. None of the photography available to date is adequate to provide the map control accuracy required for large-scale topographic maps (1:50,000).

d. Photographic


(1) Reconnaissance Aircraft. Although much aerial photography has been acquired from approximately 80 different covert air reconnaissance projects, it is not as readily useable as satellite photography. Its utility is limited because of certain

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technical factors, such as the somewhat erratic nature of flight lines, excessive tip and tilt and/or obliquity of the photography which present major technical problems in establishing stereo models and geodetically positioning these models with the required degree of accuracy. Also, the limited area of coverage per frame, as compared to satellite photography, makes the forming more difficult. However, this coverage frequently is the best and most recent available of many areas for updating and supplementing map detail.

Most of the U-2 coverage acquired for intelligence purposes has been authorized for removal from the Talent Control System and has been released with varying degrees of controlled access to permit utilization in intelligence reporting, target material production, and for MC&G products. Recent U-2 coverage in Southeast Asia and Cuba has not been included in the Talent Control System and is used as source material for the preparation of target materials. U-2 photographic materials provide supplementary information on ground features and installations in the preparation of large-, medium-, and small-scale maps and charts.

(2) Specially Equipped Aircraft. Aside from the photography collected by special reconnaissance aircraft, the DOD has a capability to collect photography by other aircraft such as the RC-130 and the RC-135 which have been particularly adapted for photo mapping. These aircraft are used in peacetime in photo mapping of nondenied areas, particularly of underdeveloped countries where the U.S. has cooperative agreements, and for U.S. missile site and other airborne electronic surveys. The wartime mission is concerned with quick response photo mapping of critical areas of importance to the war effort. The RC-135 USQ-28 systems now coming into operation have the capability for producing photo mapping suitable for large-scale maps more economically and efficiently than the present RC-130s.

(3) Satellite. Photographic satellites provide the easiest access to the total surface of the earth. In many areas of the world, they provide the only collection capability with an acceptable political risk. When compared to conventional collection methods,



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the collection process is expedient and very effective except for the equatorial belt which has a persistent cloud cover. Satellite photography is more easily reduced for mapping purposes at less man-hour costs than photography collected by conventional means.

In the equatorial belt, where heavy cloud cover is present throughout most of the year, the collection of useable photography by the use of satellites is an extremely lengthy and costly process. Unlike aircraft, satellites do not have the quick reaction capability necessary to take advantage of short-range weather forecasts, nor are they, when programmed for a priority area of intelligence interest, usually over the mapping target area at the optimum local time for mapping photography.

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g. Nonintelligence. The DOD participates in cooperative mapping, charting, and geodesy agreements with some 48 countries. Through these programs the U.S. has been able over a period of many years to initiate new mapping or accelerate previously initiated

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native mapping programs of areas of interest that otherwise might have remained unmapped and could have become an added burden on the covert programs.

Some of these agreements were with regional treaty organization countries, others were the result of a division of activity between the U.S. and the U.K. A number of agreements have been arranged under various foreign military as well as economic assistance programs. The oldest of these, the Inter-American Geodetic Survey, has been primarily military-funded on the U.S. side although some U.S. foreign economic aid has been allocated to some of the Latin American countries.

The rate of survey and map production from these cooperative agreements varies widely. Those with advanced treaty organization (NATO, SEATO, CENTO) countries are most productive in coverage since the mapping of these countries is already well advanced or the capability exists to become so. Agreements with backward countries are the most expensive and some programs become very drawn out. For example, after more than 20 years the cooperative programs under the Inter-American Geodetic Survey have yielded little in map coverage because of the lack of local funds and lack of trained indigenous personnel. Coverage has been completed only for Cuba (under Batista), Haiti and El Salvador.

Prospects for an increase in the rate of coverage under the cooperative programs are not likely to improve significantly over the present level unless much greater U.S. investments are made.

3. Mapping, Charting and Geodesy-associated R&D

a. General. A research and development effort is conducted by the government and industry toward the initiation and perfection of instruments and techniques to acquire and process cartographic, geodetic, and geophysical data with greater speed, accuracy, and economy.

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To keep pace with improved capabilities in data acquisition, considerable research is underway on the development of automated cartographic systems that will be capable of producing maps and charts in a timely manner from a variety of sensor inputs.

b. R&D Activities Within DOD. Within the DOD the proposals of the military departments are subject to coordination and review by DDR&E. Requirements and proposed funding are submitted by the military departments to the Mapping, Charting, and Geodesy RDT&E Coordinating Committee for recommendation to DIA. After a joint DIA/DDR&E Program Review, DDR&E provides a final budget recommendation to the OSD.

c. R&D Activity Within the NRO. Within the NRP R&D activities associated with MC&G are usually limited to collection devices. The NRO maintains liaison with the military departments because there are often parallel development efforts being conducted simultaneously by the NRO and the Services. For example: As a follow-on to the KH-5 frame camera, the Army began a series of studies which indicated the need for the development of a frame camera capable of meeting the large-scale map requirement. One study included the evaluation of two 18-inch focal length frame cameras and their testing in aircraft. (It is understood that two such cameras were developed but detailed information thereon was not obtainable.) This camera system was given up in preference for a 12-inch frame camera, the development of which was begun by NRO in support of USAF geodetic interests. [REDACTED]

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4. Costs Associated with Mapping, Charting and Geodesy.

a. Overall. Costs associated with the Mapping, Charting and Geodesy program include those required to support the R&D effort, the collection process and the production of maps and charts. Present cost accounting procedures do not always facilitate the identification of costs chargeable to mapping and charting separately from those chargeable to intelligence. There is a large grey area of overlapping requirements and associated costs.

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6. The Gap Between Data Collection and Map Production, and its Relationship to the Fulfillment of Emergency Military Requirements.

a. Development of an Adequate Data Bank. U.S. military commanders, charged with meeting the growing communist threat after World War II, were confronted at that time with a lack of adequate large- and medium-scale maps of most of the USSR, China, and the backward regions of the earth. Because of the vastness of the postulated worldwide mapping requirement, MC&G planning and operations were scaled to a 20-25-year time frame. Conventional methods of collecting photography and ground survey data are very time-consuming as well as expensive. Operations are additionally restricted by problems of physical and political inaccessibility. Even where access is possible, the consummation of activity from field operations to final map production for any sizeable area had to be reckoned with in terms of a decade. As a result, prior to the earth satellite, map coverage was expected to be lacking for large areas for years to come. Emergency needs for maps and charts in the gap areas were accommodated by a shift of compilation resources from established production schedules to the emergency area on a crash basis. The adequacy of such a response capability was inevitably limited by the inadequacies of the source materials in library holdings. These consisted of an accumulation of many years of a wide assortment of foreign maps, aerial photography, files of foreign geodetic, gravometric and geomagnetic data, and a collection of geographic and geophysical publications. These varied widely in date and technical quality. For vast areas there was little or no information.

(1) After DOD established the value of covert satellite photography for mapping, charting, and geodesy, their collection requirement, approved by the USIB, for KH-4 and KH-5 photography included not only photo coverage for current annual production needs but also included the acquisition of photography for a mapping data bank. The objective of the latter was to develop a 60-90 day emergency production response capability for any gap area in the JSOP coverage requirement. The completion of the data bank for emergency requirements would presumably occur when once-over photo coverage of the map

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and chart requirement area would be completed. The USIB, in April 1965, (USIB-D-41.14/229), approved a requirement for KH-4 coverage for MC&G purposes. This requirement has been substantially met except for the Equatorial (Cloud) Belt as shown in the following tabulation:

	<u>April 1965 Requirement</u>	<u>Completed</u>	<u>To Be Covered</u>
Sino Soviet Bloc	8,513,000	8,471,000	42,000
Equatorial (Cloud) Belt	6,081,000	1,277,000	4,804,000
Remainder of the World	<u>12,158,000</u>	<u>10,871,000</u>	<u>1,287,000</u>
Total	26,752,000	20,679,000	6,133,000

NOTE: Above figures are in square nautical miles and reflect a currency of 1 March 1968.

(2) The completion of the existing USIB-approved requirement for KH-4 coverage, however, will not preclude the future demand for covert satellite photography for two reasons.

(a) First, maps, charts, and photography become obsolete in time. The obsolescence rate varies from 5 to 20 years depending on the level of cultural development of an area and its rate of developmental change.

(b) Second, USIB has approved (USIB-D-41.14/295) the collection of approximately 7 to 10 million square statute miles (5.2 to 7.5 million nautical miles) annually for medium- and large-scale map production. When this approval was granted no details of the production plan were provided. Subsequently, it has been disclosed that the total large-scale production plan amounts to 6.7 million square miles (5.05 million nautical miles). This is dependent on satellite photography. The additional photo coverage is desired by DIA as insurance to be used in meeting emergency requirements for large-scale maps of areas not included in the scheduled production program and to produce the remaining required coverage for medium-scale maps and charts more

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nearly accurate. The large-scale photo coverage will also be used for the maintenance up-to-date of all small- and medium-scale map products.

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b. The Map Production Program. The DOD map and chart production program is highly complex in nature because of the diversity of the products involved, the large number of product units (sheets) programmed, and the extensiveness of the area covered. More than fifty different products make up the production program. Some understanding of the magnitude of this program can be gleaned from the fact that five of the major large- and medium-scale series which provide continuous coverage will number over 102,000 map sheets, which, when taken together, will cover a total of 105,800,000 square miles of area. Coverage of the whole earth is additionally produced in the small-scale series totaling 868 sheets. Two other major products are the airfield sketches, which number 22,000 units, and the Tactical Target Illustrations (TTI), which number 31,574 units. Therefore, at any point in time a significant number of these products are being processed varying only in area and rate of production according to government priorities existent at that time. This means that photo coverage anywhere in the world may be required for one program or another at any one point in time.

(1) The five-year program beginning with FY-67 calls primarily for the stereo photogrammetric production of new sheets as well as for the recompilation by stereo photogrammetric methods of previously existing maps which earlier had undergone an updating of cultural detail only. A major production goal in this program period is the completion of the medium-scale coverage of 90 percent of the earth's surface. To achieve this coverage, total medium-scale map production is scheduled to rise from

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3,700,000 square miles in FY-67 to 9,300,000 square miles in FY-68, and to level off at about 8,000,000 square miles annually in the early 1970's. A major deterrent in fully achieving this goal, however, will be the unavailability of photo coverage for the cloudy equatorial belt of the earth--representing about 3,000,000 to 5,000,000 square miles.

(2) After 1973, the medium-scale coverage will enter a maintenance phase, to keep the map coverage up-to-date. In addition, some stereo photogrammetric recompilation will be required on sheets that were produced from the early satellite photography where the product accuracies were below acceptable standards.

Large-scale map production is scheduled to remain at a minimal level during the FY 67-73 period unless photography collected by a longer focal length frame camera becomes available. Production is now scheduled at the rate of about 300,000 square miles per year, and will be limited to (a) the production accomplished by the NATO and other cooperating countries, (b) the utilization of conventional photography as it becomes available, and (c) the revision of cultural detail of existing large-scale coverage from satellite photography.


7. Future Needs

a. General. The identification of future MC&G needs is complicated by rapid technological advancements as well as by institutional changes which are difficult to predict. For example, the Mark XVII Minuteman weapon system, upon which current approved geodetic accuracy requirements are predicated, has been displaced by the multiple warhead delivery system. The 1965 USIB statement of the geodetic accuracy requirement is therefore affected, but the impact of this change has not been reflected in a re-statement of the earlier accuracy requirement. A review within DOD of the priority that should be given to the procurement of a camera system designed for the covert collection of photography for the large-scale map requirements resulted in a decision that such a system would be procured but that the cost of the program would have to be borne by

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diverting funds from other MC&G programs. Some trends affecting covert satellite operations are perceivable. Changes in military weapons system capabilities generally are reflected in the requirement for improved mapping accuracies. In the past, for example, whenever a new collection capability was evaluated, it generally lead to worldwide re-coverage requirements. Finally, the currently emerging interest in the utilization of covert satellite photography by civilian agencies and departments points to a host of wider applications that may greatly affect covert satellite planning and operations as well as the exploitation of the photography and the related security controls.

b. Accuracy Requirements

(1) Map Control. Current large-scale map accuracy requirements, which are the most stringent of all mapping requirements, are established on the basis of providing map accuracies which will be commensurate with the advanced artillery which is projected to be in the military inventory for 1975 and beyond. Future advances in artillery development beyond this time frame are most likely to be directed toward increased range. This would lead to a requirement for an extension of the vertical map accuracies in contiguous sheet coverage beyond the current 20-kilometer radius criteria. This, in turn, could require additional coverage by improved camera systems.

For areas outside the continental limits of the United States, future civil accuracy requirements appear unlikely to exceed those established for the military services.

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Navy, Air Force, CIA, and NSA serving as members. Because most of the requirements are in support of military operations, they usually have been accepted in the past without stringent validation procedures. Requirements forwarded to COMIREX by the Working Group are scrutinized primarily from the standpoint of possible impact on priority intelligence targets rather than from a validity standpoint. They are generally accepted as supporting the needs of the military departments. In some cases, however, the USIB channel is not followed. [REDACTED]

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b. Participation in Review of the NRP. Within the NRP, the DCI, as a member of the executive committee, expresses himself as a monitor of the NRP budget and of the procurement of hardware in support of collection requirements. At times documents are received from the NRO which lack sufficient detail for close examination. The budget is not broken down in a manner in which MC&G costs can be easily identified and evaluated. In addition, a response is often requested within a time frame that does not permit a detailed examination to be made and a position to be properly staffed and presented. Under these circumstances the DCI is placed in a position of making judgments involving large sums of money without adequate opportunity for the evaluation of the information.

c. Participation in Review of the CIP. The Consolidated Intelligence Program of the DOD is a principal arena in which the mapping, charting, and geodesy resource requirements are spelled out in considerable detail. This programmatic presentation, which includes related data on costs and manpower, encompasses most of the major aspects of the military resources devoted to MC&G. For fiscal 1969, this proposed program amounts to [REDACTED]

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[REDACTED] in the CIP, and is exclusive of NRP costs for MC&G. The review process for the CIP takes place within the Defense Department; the DCI is represented in the review by a member of the NIPE Staff. The DCI has further opportunity to comment on the CIP directly to the Secretary of Defense, who is the


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recipient of the CIP Review Group recommendations, to the extent he may desire. The problem that arises in regard to making comments on the MC&G area is that, while it is presented as an intelligence program, the proposals are predominantly a reflection of military operational requirements. Furthermore, except for the once-a-year activity of the CIP Review Group, there has been no vehicle through which the DCI can evaluate the contributions that the varied and complex systems and programs make to the overall MC&G effort, or where the CIP and NRP programs can be inter-related. For these reasons, the DCI representative on the CIP Review Group can have only an instinctive feel for the appropriateness of the MC&G line item in the CIP.

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